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Commercial Economic Poisons Commonly Known as Fungicides and Insecticides

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TABLE OF CONTENTS

	Page
Introduction	5
The Enforcement of the Economic Poison Act	5
The Oregon Economic Poison Act	6
List of Registered Manufacturers	7
Inspection, Collection, and Analyses of Samples	8
Analytical Report of Samples	9
Lime-sulfur Solution	9
Dry Lime-sulfur	9
Lead Arsenate	10
Calcium Arsenate	11
Paris Green	11
Nicotine Compounds and Dusts	13
Sulfur and Miscellaneous Dusts	14
Dry Bordeaux Mixture	17
Copper Carbonate and Copper Sulfate	17
Copper and Arsenic Preparations and Compounds	17
Oil Sprays	18
Formaldehyde	19
Soap	19
Pyrethrum Sprays	19
Mercuric Fungicides	21
Miscellaneous Spray Materials	21

Commercial Economic Poisons Commonly Known as Fungicides and Insecticides

By

R. H. Robinson and C. F. Whitaker

INTRODUCTION

The demand for insecticides and fungicides has increased a hundred fold during the past few years. As a consequence many different brands of various products are offered to the consuming public. Before any spray material can be recommended for the control of insect pests for fungous diseases, it is necessary to know, first, what active constituents predominate, and second, what amount or percentage of each active ingredient is present. This is especially important since the appearance on the market of many proprietary mixtures having the same active ingredients but in widely different amounts. For example, there are now for sale in the state more than 50 different brands of nicotine compounds that vary from 0.5 to 40.0 percent in the active ingredient nicotine. Likewise, the different brands of dusting sulfur, copper carbonate, dry bordeaux mixtures, or any other commercial spray may vary greatly in composition. There are also worthless materials that contain little if any fungicidal or insecticidal properties.

This publication reports the chemical analyses of various spray materials collected in carrying out the provisions of the Oregon economic poison law. In order to obtain a better understanding of the requirements of each spray material, the active ingredients are discussed briefly and desirable standards are indicated.

THE ENFORCEMENT OF THE OREGON ECONOMIC POISON ACT

The Oregon Economic Poison Act was passed by the State Legislature in 1923 in order, first, to prevent the sale of fraudulent material, and second, that the farmer might know more definitely the composition of commercial spray compounds. The law provided that the station chemist, acting for the Director of the Agricultural Experiment Station, should administer and enforce the provisions of the act. Accordingly, up to the present time, the Chemistry department of the Agricultural Experiment Station has supervised and carried out all provisions pertaining to the law, issued permits to various spray manufacturers, inspected, collected, and analyzed spray samples during the active season, and published reports covering the work done.

The 1931 session of the State Legislature passed a bill creating a Department of Agriculture of the State of Oregon, assigning to the new Department, beginning July 1, 1931, the administration of the Oregon Economic Poison Act and the supervision of the enforcement of the law. On and after that date, therefore, all correspondence and questions pertaining to the Oregon Economic Poison Law should be addressed to the Director of the State Department of Agriculture, Salem, Oregon.

The various phases of investigational and experimental work, such as the study of the compatability of various new spray mixtures, the effectiveness of a product for specific purposes, and precautions necessary in the use of certain products, will be continued by the Chemistry department of the Experiment Station.

THE OREGON ECONOMIC POISON ACT

The term "Economic Poison" has been adopted to mean all chemicals, substances, or combinations of substances that are poisonous to insects, fungi, or weeds, regardless of whether or not they are poisonous to human beings.

The Economic Poison Law provides "That any substance or mixture of substances intended to be used for preventing, destroying, repelling, or mitigating any and all insects, fungi, or weeds, shall be registered at the Office of the Director of the Oregon Experiment Station (on and after July 1, 1931, at the Office of the Director of the State Department of Agriculture) and a permit shall be issued therefrom before the same can be offered for sale."

The law also provides that a plainly printed label must be attached to each original package of economic poison, stating the following:

1. Name, brand, or trademark.
2. Name and percentage of each active ingredient.
3. Total inert ingredients.
4. Date of manufacture.
5. Name and address of the manufacturer.

Farmers or other consumers should examine the label of any spray material purchased and report to the Chemist of the Agricultural Experiment Station (on and after July 1, 1931, to the Director of the State Department of Agriculture) any omissions of the foregoing requirements.

TO WHOLESALERS, DEALERS, AND SALESMEN: Wholesalers, dealers, salesmen, or other persons selling or offering for sale any economic poisons in the state, are requested to ascertain from the Chemist of the Agricultural Experiment Station (on and after July 1, 1931, from the Director of the State Department of Agriculture) whether or not the material has been registered by the manufacturer. If not, they must register the different brands on their own guarantee or request the manufacturer to register them before they handle them. No economic poison can be legally sold in the state of Oregon until registered and a permit issued to the party responsible for its sale.

LIST OF REGISTERED MANUFACTURERS

During the 1930 and 1931 seasons the following manufacturers have registered their products and have been granted a permit to sell their goods in the state:

Acme White Lead & Color Works	8250 Aubin Street, Detroit, Mich.
Agricultural Chemical Works	905 Mary Street, Los Angeles, Calif.
American Smelting & Refining Co.	405 Montgomery St., San Francisco, Calif.
Associated Oil Company	79 Montgomery St., San Francisco, Calif.
American Cyanamid Sales Company	Azusa, Calif.
An-Fo Manufacturing Company	3129 Elmwood Ave., Oakland, Calif.
Antrol Laboratories	651 Imperial St., Los Angeles, Calif.
Balfour Guthrie & Company	351 California St., San Francisco, Calif.
Bayer-Semesan Company	105 Hudson Street, New York City
Bear Creek Spray Corp.	Medford, Oregon
Buhack Producing & Mfg. Company	37 E. Channel St., Stockton, Calif.
Bonide Chemical Company	Utica, N. Y.
Braun-Knecht Heimann Company	584 Mission St., San Francisco, Calif.
California Spray-Chemical Co.	Watsonville, Calif.
Calispray Manufacturing Company	111 N. Ave. 60, Los Angeles, Calif.
Carco Spray Company	Tacoma, Wash.
Chipman Chemical Engineering Co.	Bound Brook, N. J.
Cooper, Wm., & Nephews	1909 Clifton Ave., Chicago, Ill.
Cowles-Lamgenheim Corp.	6561 Santa Monica Blvd., Los Angeles, Calif.
Crown Willamette Paper Co.	736 Pittock Bldg., Portland, Oregon
D & B Chemical Company	800 E. 37th Street, Portland, Oregon
Devoe and Raynolds	14 West Lake Street, Chicago, Ill.
Dow Chemical Co.	Midland, Mich.
Durbocide Chemical & Machine Corp.	483 Hawthorne Ave., Portland, Oregon
Easy Sprayer & Chemical Mfg. Co.	1534 Oregon St., Berkeley, Calif.
Forsell & Company, M. J.	2224 5th Ave., Seattle, Wash.
M. Furuya Company	216 Second Ave. So., Seattle, Wash.
General Chemical Company	201 Sansome St., San Francisco, Calif.
Gideon Stolz Company	Salem, Oregon
Gleason, R. E.	Freewater, Oregon
Gregory, A. R.	31 Sacramento St., San Francisco, Calif.
Grasselli Chemical Co.	Cleveland, Ohio
Griffith-Lothrop Company	1420 Sacramento St., Portland, Oregon
Halfhill Company	783 Ceres Ave., Los Angeles, Calif.
Hammond's Paint & Slug Shot Works	Beacon, New York
Hemingway Co.	Shellmound & Horton Streets, Oakland, Calif.
Hood River Spray Company	Hood River, Oregon
Hooker Electrochemical Company	25 Pine St., New York City, N. Y.
Kalo Company	615½ Hampshire St., Quincy, Ill.
Latimer-Goodwin Chemical Co.	Grand Junction, Colo.
Leckenby, Harry N.	Pier No. 40, Seattle, Wash.
Leffingwell Rancho Company	Whittier, Calif.
Leis, Mr. B.	Beaverton, Oregon
Lilly Company, The Chas. H.	Seattle, Wash.
Lucas Kill-Tone Company	Vineland, N. J.
Mailliard & Schmiedell	701 Board of Trade, Portland, Oregon
Miller Products Company	Foot of Lincoln St., Portland, Oregon
Michel & Pelton Company	5743 Landregan St., Emeryville, Calif.
Monsanto Chemical Works	1724 S. 2nd St., St. Louis, Mo.
McCormick & Company	Baltimore, Md.
Montgomery Ward & Company	Portland, Oregon
Mountain Copper Co.	112 Market St., San Francisco, Calif.
Mt. Hood Soap Company	270 Glisan St., Portland, Oregon
Mulford Co., H. K.	Board & Wallace Sts., Philadelphia, Pa.
McLaughlin Gormley King Company	1715 5th St., Minneapolis, Minn.
Niagara Sprayer & Chemical Co.	Middleport, N. Y.
Nicotine Production Corp.	Clarksville, Tenn.
Nichols Copper Company	23 Broad Street, New York City
Parke Davis & Company	Ft. of McDougall St., Detroit, Mich.
Pittsburg Plate Glass Co.	Corona Chem. Div., 205 Pittsburg Ave., Milwaukee, Wis.

Pest-Go Company	912 Western Ave., Seattle, Wash.
Portland Gas & Coke Company	Portland, Oregon
Rex Research, Inc.	Benicia, Calif.
Roessler & Hasslacher Chem. Co.	709 Sixth Ave., New York City
San Francisco Sulfur Company	636 California St., San Francisco, Calif.
San Jose Spray Mfg. Company	585 Emery Street, San Jose, Calif.
Sexton Company, Leonard	Freewater, Oregon
Sure-Grow Machine Mfg. Company	495 Hawthorne Ave., Portland, Oregon
Sherwin-Williams Co.	1450 Sherwin Ave., Oakland, Calif.
State Bate Company	2177 32d St., So., Portland, Oregon
St. Helens Pulp & Paper Company	St. Helens, Oregon
Sutherlin Spray Company	Sutherlin, Oregon
Texas Company	929 S. Broadway, Los Angeles, Calif.
The Dalles Spray Company	The Dalles, Oregon
Tobacco By-Products & Chem. Corp.	Louisville, Ky.
U. S. Smelting, Refining & Mining Company	Newhouse Bldg., Salt Lake City, Utah
Valley Fruit Company	Walla Walla, Wash.
Weed Destroyer Company	Aberdeen, Wash.
Wheeler, Raynolds and Satuffer	624 California St., San Francisco, Calif.
Wiarda & Co., John C.	200 5th Ave., New York City
Yakima Valley Spray Co.	Yakima, Wash.

If any brands of economic poison are offered for sale that have not been registered by one of the foregoing manufacturers, the Chemist of the Agricultural Experiment Station (on and after July 1, 1931, the Director of the State Department of Agriculture) should be notified. Such materials should be considered questionable until the manufacturer registers and guarantees them.

Another important purpose of the law is to prevent the sale of those materials that have little or no value as economic poisons. As stated in Section 8 of the law, "the Director of the Experiment Station (on and after July 1, 1931, the Director of the State Department of Agriculture) has power to refuse to register any material that has been shown to have little or no value for the purpose for which it is intended to be used." Thus far registration has been denied several worthless materials and their sale discontinued.

INSPECTION, COLLECTION, AND ANALYSES OF SAMPLES

During the active spraying season representative samples of different brands of insecticides, fungicides, and weed killers are collected and analyzed. Those brands that show a lower percentage of active ingredients than is guaranteed by the manufacturer receive especial attention. The manufacturer is notified to change the guarantee or improve his product. If he fails repeatedly to do so or in any other way violates the provisions of the act, legal action is taken against him. Dealers, moreover, are requested not to handle the product, and publicity is given advising against its use.

During the years 1930 and 1931 more than 350 different brands of economic poisons were registered. On account of the large number available it is impossible to obtain samples of all brands. Instead, attention is centered on certain classes of materials, especially those spray materials that are in common use or are subject to chemical changes. Certain manufacturers also are more careful than others and their products may be depended upon as being in accordance with their guarantee. These may necessitate only occasional attention.

New brands and new spray materials are given especial attention. The Agricultural Chemistry department in cooperation with other departments of the Agricultural Experiment Station will be pleased to give available information and advice regarding the composition, use, and effectiveness of different types of sprays.

ANALYTICAL REPORT OF SAMPLES

In the following pages are reported the guaranteed and found composition of economic poisons collected during the past season. Comments are made relative to the chemical nature and stability of each material.

Lime-sulfur solution. Sulfur, chemically combined with calcium to form calcium polysulfide, is the principal active ingredient in lime-sulfur solution. For all practical purposes its concentration is indicated by the hydrometer test. This, for commercial brands, should be at least 30° Baumé at 60° F.

Lime-sulfur solution as locally prepared is perhaps subject to greater variation in composition than most sprays. When a poor grade of lime is used or the operator is careless in boiling the solution, the Baumé reading may be low. The orchardist is advised to test the lime-sulfur solution with a Baumé hydrometer and make dilutions for spraying in accordance with Table II of Oregon Agricultural Experiment Station Bulletin 259. If the test is below the Baumé guaranteed on the label it should be reported immediately to the Agricultural Chemistry department of the Experiment Station (on and after July 1, 1931, to the Director of the State Department of Agriculture). A pint sample also should be sent with the report.

Manufacturers are requested to label all barrels of lime-sulfur solution showing the minimum Baumé reading guaranteed by them. Although the Baumé reading indicates approximately the strength of the lime-sulfur solution, the important active ingredients, polysulfide sulfur and the total sulfur, are also given. The results are reported in Table I.

From the results in Table I it is apparent that some brands are below the guarantee. The deficiency, even though small, should not be overlooked.

Dry lime-sulfur. There are several brands of dry lime-sulfur sold in Oregon. Although a powder, this is not a dusting spray but must be dissolved in water before it is applied. The dry lime-sulfur should give as effective results as the liquid lime-sulfur *if used in equivalent amounts.* The amount should be at the rate of 5.0 pounds of the dry material for each gallon of concentrated lime-sulfur required.

The different brands of the dry lime-sulfur vary somewhat in composition. They should contain a minimum of 65.0 percent of calcium polysulfide, the principal active ingredient, and not more than 12 percent free, uncombined sulfur. Even a higher amount of calcium polysulfide is desirable. It is important, therefore, to note the guaranteed statement on the label and to examine the analytical report given in Table II.

Unless dry lime-sulfur is kept in air-tight containers it may partly decompose, whereupon, owing to the decreased polysulfide content of the oxidized material, its value as a dormant spray is greatly diminished.

The analyses given in Table II show that some of the brands are below the guaranteed amount of the main active ingredient, calcium polysulfide. On the other hand, the free sulfur is higher than the guarantee. This combination decreases the value of the material as dormant spray although the excess free sulfur may be beneficial in summer sprays.

TABLE I. LIME-SULFUR SOLUTION

Name of manufacturer	Address	Guaranteed and found	Baumé degrees	Total sulfur	Calcium polysulfide
				%	%
Bear Creek Spray Company	Medford, Oregon	Guaranteed	32.0	.....	.....
		Found	32.8	25.1	30.8
B. Leis	Beaverton, Oregon	Guaranteed	30.0	.....	.....
		Found	29.9	22.3	27.0
General Chemical Company	San Francisco, Calif.	Guaranteed	32.0	.....	29.0
		Found	32.1	24.9	30.1
Gideon Stolz	Salem, Oregon	Guaranteed	30.0	.....	27.24
		Found	31.1	23.9	29.1
Hood River Spray Company	Hood River, Oregon	Guaranteed	32.0	24.0	.....
		Found	31.9	24.6	30.8
Miller Products Company	Portland, Oregon	Guaranteed	30.0	22.07	.....
		Found	30.4	25.2	29.9
National Chemical Company	San Francisco, Calif.	Guaranteed	32.0	25.0	29.0
		Found	32.0	25.3	30.9
Sutherlin Spray Company	Sutherlin, Oregon	Guaranteed	30.0	.....	.....
		Found	30.6	21.5	26.6
Sutherlin Spray Company	Sutherlin, Oregon	Guaranteed	30.0	.....	.....
		Found	28.1	.....	.....
The Dalles Spray Company	The Dalles, Oregon	Guaranteed	30.0	.....	.....
		Found	30.3	20.6	27.4

Unless dry lime-sulfur is packed in air-tight containers it should be used soon after it is placed on the market. Otherwise it deteriorates rapidly and its value as a spray is greatly diminished. Buyers should refuse to accept broken packages or portions taken from them.

Lead arsenate. The lead arsenate used in Oregon is mainly the lead hydrogen arsenate form. This form is more toxic than the basic or neutral lead arsenate type and consequently the latter is used very little in this state. Lead hydrogen arsenate is a standardized product that does not vary greatly in composition. It can be relied upon generally to be in accordance with the guarantee.

The toxicity of the different commercial brands of arsenate of lead is practically the same. This is a natural conclusion since during the past decade or more there has been very little variation in the chemical composition of the different brands. Some of the commercial brands contain small amounts of deflocculents or spreaders, while others do not. These deflocculents or spreaders may aid to a limited extent in dispersing the lead arsenate particles in the spray solution, and may also reduce chemical

action when used in certain combination sprays. On the other hand, the orchardist may add spreaders to those brands containing none and obtain similar results. Since no particular commercial brand of lead arsenate has given outstanding results consistently over a period of years, the choice of a certain brand is principally a matter of a personal preference for a certain type.

TABLE II. DRY LIME-SULFUR

Name of manufacturer	Address	Guaranteed and found	Calcium polysulfide	Calcium thiosulfate	Free sulfur
			%	%	%
Acme White Lead and Color Works	Detroit, Mich.	Guaranteed	70.0	5.0	10.0
		Found	67.8	6.6	12.3
Devoe and Raynolds	Chicago, Ill.	Guaranteed	70.0	5.0	10.0
		Found	67.1	5.2	9.4
Dow Chemical Company	Midland, Mich.	Guaranteed	70.0	5.0	10.0
		Found	67.9	8.1	5.8
Lucas Kil-Tone Company	Vineland, N. J.	Guaranteed	70.0	5.0	10.0
		Found	72.5	6.9	11.6
Niagara Sprayer and Chemical Company	Middleport, N. Y.	Guaranteed	70.0	5.0	10.0
		Found	73.7	7.1	9.8
Sherwin-Williams Company	Oakland, Calif.	Guaranteed	65.0	5.0	10.0
		Found	69.6	6.7	10.9

The analyses of the different brands as shown in Table III further confirm this statement. Where the manufacturer has guaranteed 98 percent lead arsenate it is assumed that the product will contain a minimum of 30.0 percent arsenic oxide and 63.0 percent lead oxide.

Calcium arsenate. There are a few brands of calcium arsenate offered on the Oregon market. On account of the unstableness of this arsenical it cannot be used safely as an orchard spray and consequently local demand for it is comparatively small. Calcium arsenate can be substituted advantageously for paris green for most purposes, especially in truck-garden insect pest control. Calcium arsenate costs less than paris green, contains 40 percent of the active ingredient arsenic oxide, and is less water soluble.

Calcium arsenate that has been kept in storage for some time may show an abnormally high water-soluble arsenic oxide content. It is important, therefore, that calcium arsenate be stored in air-tight drums and used within a reasonably short time after opening. If calcium arsenate is to be used on tender foliage it is a wise precaution to add hydrated lime at the rate of about one pound to the hundred gallons. This will reduce any water-soluble arsenic oxide that may form and thus prevent danger of foliage injury.

Paris green. Although paris green has been superseded by calcium arsenate and lead arsenate it is still in demand and available on the Oregon market. It finds an important place as the active ingredient of insect baits that cannot be used as a foliage spray. It may contain as much as 3.5 per-

cent water-soluble arsenous oxide, which, owing to danger of causing foliage burn, limits its use to hardy plants.

TABLE III. LEAD ARSENATE

Name of manufacturer	Address	Guaranteed and found	Total arsenic oxide	Water soluble arsenic oxide
			%	%
Acme White Lead and Color Works	Detroit, Mich.	Guaranteed	29.6	1.07
		Found	32.0	.07
Devoe and Raynolds	Chicago, Ill.	Guaranteed	30.0	.70
		Found	32.5	.30
Dow Chemical Company	Midland, Mich.	Guaranteed	30.0	.75
		Found	32.9	.23
General Chemical Company	San Francisco, Calif.	Guaranteed	30.0	.38
		Found	32.8	.08
Graselli Chemical Company	Cleveland, Ohio	Guaranteed	30.0	.75
		Found	32.1	.07
Latimer-Goodwin Chemical Company	Grand Junction, Colo.	Guaranteed	30.0	.50
		Found	29.0	.07
Lucas-Kil-Tone Company	Vineland, N. J.	Guaranteed	30.0	1.00
		Found	32.3	.10
National Chemical Company	San Francisco, Calif.	Guaranteed	30.0	.50
		Found	32.6	.06
Niagara Sprayer and Chemical Company	Middleport, N. Y.	Guaranteed	30.0	.77
		Found	31.3	.09
Pittsburg Plate Glass Company	Milwaukee, Wis.	Guaranteed	30.0	.75
		Found	33.0	.15
Sherwin-Williams Company	Oakland, Calif.	Guaranteed	30.0	.36
		Found	31.8	.06

TABLE IV. CALCIUM ARSENATE

Name of manufacturer	Address	Guaranteed and found	Arsenic oxide: Total	Arsenic oxide: Water soluble
			%	%
Acme White Lead and Color Works	Detroit, Mich.	Guaranteed	40.0	.76
		Found	40.8	Trace
Devoe and Raynolds	Chicago, Ill.	Guaranteed	40.0	.....
		Found	41.4	.....
Lucas Kil-Tone Company	Vineland, N. J.	Guaranteed	40.0	.....
		Found	42.9	.....
Niagara Sprayer and Chemical Company	Middleport, N. Y.	Guaranteed	40.0	.75
		Found	40.0	Trace
Sherwin-Williams Company	Oakland, Calif.	Guaranteed	40.0	.50
		Found	42.1	Trace

Nicotine compounds and dusts. Especial care should be exercised in the purchase and subsequent handling of certain nicotine combinations. The dealer who retails nicotine sprays should thoroughly understand the different combinations. This is important because some lose their nicotine content very rapidly, while others may be kept indefinitely without loss of the active ingredient.

TABLE V. PARIS GREEN

Name of manufacturer	Address	Guaranteed and found	Total arsenous oxide	Total copper oxide	Water-soluble arsenous oxide
			%	%	%
Acme White Lead and Color Works	Detroit, Mich.	Guaranteed	50.0	.....	3.5
		Found	54.6	30.0	2.3
Devoe and Raynolds	Chicago, Ill.	Guaranteed	30.0	.....	3.5
		Found	53.5	30.3	.9
Sherwin-Williams Company	Oakland, Calif.	Guaranteed	50.0	.....	3.5
		Found	53.5	30.3	.8

Nicotine sulfate in liquid form is very stable and may be kept indefinitely without deterioration. The highest-grade form is a solution of nearly 50 percent nicotine sulfate in water containing 40 percent nicotine. It is sold on the Oregon market as "Black Leaf 40," N.P.C. Nicotine, and Ortho nicotine sulfate.

Nicotine dusts may or may not be stable compounds. The stability of the combination depends upon the carrier used to hold the nicotine. The importance of nicotine dusts warrants detailed explanation.

In the preparation of nicotine dusts the use of some carrier or filler is necessary to hold the alkaloid which is the active ingredient and distribute it uniformly as a powder. Thatcher and Streeter of the New York Agricultural Experiment Station classify the carriers in three divisions:

First, "absorbent" carriers, which tend to prevent volatilization of the nicotine. This class of materials may be represented by talc, kaolin, and kieselguhr.

Second, "inert" carriers, which have no other effect than to distribute the nicotine so as to expose a larger surface for evaporation. This class may be represented by gypsum, sulfur, and slate dust.

Third, "active" carriers, which increase the volatility of the nicotine sulfate by changing it to a more volatile form. This class may be represented by hydrated lime, calcium carbonate (limestone), and magnesium carbonate.

Immediately after nicotine sulfate is mixed with one or more of the several carriers or fillers the probability of loss may be summarized as follows:

(1) With hydrated lime or calcium carbonate (limestone) significant losses will occur rapidly. Air-tight containers prevent this loss to a very limited extent only. Notable losses under these conditions have been observed, due perhaps to chemical changes. In paper bags half or more

of the nicotine may be lost in thirty days. In cartons practically all the nicotine would be lost in six months.

(2) When any of the absorbent or inert carriers are used together with either hydrated lime or calcium carbonate similar losses may be expected as noted under (1).

(3) With kaolin, talc, kieselguhr, sulfur, or similar carriers, no appreciable losses may be anticipated.

(4) Tobacco leaf or waste pulverized dust will not lose its nicotine unless hydrated lime is mixed with it.

From the foregoing it is apparent that unless the carrier is known, any commercial nicotine dust should be used as soon as possible after it has been prepared. Dust held over from the previous season should be discarded unless it is known that only "absorbent" or "inert" carrier was used in the mixture. It is not advisable to purchase nicotine dusts taken from broken packages.

TABLE VI. NICOTINE COMPOUNDS

Brand	Name of manufacturer	Address	Guaranteed and found	Nicotine	
				%	
Acme Nicotine Sulfate	Acme White Lead and Color Works	Detroit, Mich.	Guaranteed	40.0	
			Found	41.1	
Aphido	Miller Products Company	Portland, Oregon	Guaranteed	14.0	
			Found	11.6	
N.P.C. Nicotine Sulfate	Nicotine Products Corporation	Clarksville, Tenn.	Guaranteed	40.0	
			Found	40.9	
Tobacco Soap Spray	Chas. H. Lilly Company	Seattle, Wash.			Also soap
			Guaranteed	2.0	6.0
			Found	2.2	6.9

Nicotine dusts may be home-prepared satisfactorily. Directions for the preparation of these dusts may be obtained by writing to the Chemistry department of the Oregon Agricultural Experiment Station.

During the past season samples of the various nicotine compounds were collected. Only new stock samples were analyzed although several brands of old stock were inspected. No doubt the old stock would be deficient in nicotine and the dealers were advised accordingly. The persons or firms having last year's goods were advised to handle only what could be disposed of during the active spraying season.

Tables VI and VII contain the results of analyses.

Sulfur and miscellaneous dusts. In this classification are placed the powdered sulfurs, sulfur–lead arsenate, sulfur–hydrated lime, bordeaux–lead arsenate, and other combinations.

It is important to examine the label of these dusts in order to know how much of the active ingredients the dust is guaranteed to contain. Some of them may consist mainly of cheap, inert filler combined with enough of the active poison to permit its sale legally as an insecticide or fungicide. Also the fineness of the sulfur particles determines its effectiveness for a

specific purpose. The Oregon Agricultural Experiment Station can advise on this point. Table VIII contains the analyses of a limited number of these samples, most of which are high grade.

TABLE VII. NICOTINE DUSTS

Brand	Name of manufacturer	Address	Guaranteed and found	Nicotine	Sulfur	Other ingredients	
				%	%		%
Aphis Dust-A	Harry N. Leckenby	Seattle, Wash.	Guaranteed	3.0	.....		.....
			Found	2.8	.....		.....
Niagara All-in-one	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	1.0	75.0	Arsenic oxide	2.7
			Found	1.3	73.6	Arsenic oxide	2.9
Niagara A-1 Mixture	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	2.7	.....		.....
			Found	2.8	.....		.....
Niagara No. 6 Nicotine Dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	2.0	.....		.....
			Found	2.2	.....		.....
Niagara No. 7 Dust with Sulfur and Nicotine	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	2.25	40.0		.....
			Found	3.4	36.1		.....
Niagara No. 10 Nicotine Dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	3.25	.....		.....
			Found	3.87	.....		.....
N-S-P Dust	Hood River Spray Company	Hood River, Oregon	Guaranteed	1.0	73.0	Arsenic oxide	2.8
			Found	.65	67.3	Arsenic oxide	3.1

TABLE VIII. SULFUR AND MISCELLANEOUS DUSTS

Brand	Name of manufacturer	Address	Guaranteed and found	Arsenic oxide	Sulfur	Copper
				%	%	%
Dry Mix	Hood River Spray Company	Hood River, Oregon	Guaranteed	3.00	90.0	.....
			Found	3.16	88.0	.....
Carnation Dusting Sulfur	Montgomery Ward and Company	Portland, Oregon	Guaranteed	.....	99.0	.....
			Found	.....	98.3	.....
Copper Dust	Hood River Spray Company	Hood River, Oregon	Guaranteed	.....	.....	.....
			Found	.....	.....	8.18
Mulsoid Sulfur	The Sherwin-Williams Company	Oakland, Calif.	Guaranteed	.....	.....	.....
			Found	.....	98.8	.....
Niagara Arleca Dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	6.00	.....	.....
			Found	6.57	.....	.....
Niagara Copo Dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	.....	7.00
			Found	.....	.....	7.12

TABLE VIII. SULFUR AND MISCELLANEOUS DUSTS (*Continued*).

Brand	Name of manufacturer	Address		Guaranteed and found		
				Arsenic oxide	Sulfur	Copper
				%	%	%
Niagara Dry Mix	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	61.0	.....
			Found	.....	**61.4**	.....
Niagara D-6 Mixture	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	.....	6.82
			Found	.....	.....	**7.28**
Niagara Ento-Dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	29.40	.....	.....
			Found	**31.10**	.....	.....
Niagara Fruitex	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	4.50	82.0	.....
			Found	**4.55**	**85.1**	.....
Niagara Kolo-dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	90.0	.....
			Found	.....	**89.8**	.....
Niagara Kolo-form	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	54.0	.....
			Found	.....	**54.9**	.....
Niagara Kolokill	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	4.50	73.0	.....
			Found	**4.29**	**75.5**	.....
Niagara No. 217 Kolotex Dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	3.00	77.0	.....
			Found	**3.14**	**81.6**	.....
Niagara Pomo-dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	3.00	87.0	.....
			Found	**3.16**	**89.8**	.....
Niagara Pomo-Green	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	3.00	71.0	.....
			Found	**3.13**	.....	.....
Niagara Sulfo-dust	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	92.0	.....
			Found	.....	**93.0**	.....
Niagara Superfine Dusting Sulfur	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	99.5	.....
			Found	.....	**99.8**	.....
Niagara 80-20	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	6.00	77.0	.....
			Found	**5.75**	**81.2**	.....
Niagara 85-15 Mix	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	4.41	.....	.....
			Found	**4.56**	.....	.....
S 440 Bluestone Mixture	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	.....	.....	22.4
			Found	.....	.....	**22.5**
S P Calatine	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed	5.60	.....	.....
			Found	**8.83**	.....	.....
Sulfo	Miller Products Company	Portland, Oregon	Guaranteed	.....	80.0	.....
			Found	.....	**75.8**	.....
Sure Noxem	Devoe and Raynolds	Chicago, Ill.	Guaranteed	2.32	6.0	.....
			Found	**2.96**	**8.3**	.....

Dry bordeaux mixture. The different brands of commercial bordeaux mixture are subject to considerable variation in the active ingredient copper. Obviously a bordeaux that contains 22 percent copper is superior to one that contains 13 percent. Nearly as important, however, is the physical condition of the material. Field experiments have shown that unless the powder is superfine it will not adhere sufficiently long to give control comparable with the home-prepared bordeaux mixture.

Table IX shows that most of the dry bordeaux mixtures are in accord with the manufacturer's guarantee for the amount of the active ingredient copper.

TABLE IX. BORDEAUX MIXTURES

Brand	Name of manufacturer	Address	Guaranteed and found	Copper
				%
Acme Bordeaux	Acme White Lead and Color Works	Detroit, Mich.	Guaranteed Found	12.75 13.81
Acme Bordeaux	Acme White Lead and Color Works	Detroit, Mich.	Guaranteed Found	12.75 13.42
Bordeaux	Devoe and Raynolds	Chicago, Ill.	Guaranteed Found	13.00 15.50
Bordow	Dow Chemical Co.	Midland, Mich.	Guaranteed Found	12.75 13.78
Cloros Dry Bordo 12%	Lucas Kil-Tone Co.	Vineland, N. J.	Guaranteed Found	12.00 12.12
Fungi Bordo	Sherwin-Williams Co.	Oakland, Calif.	Guaranteed Found	12.75 13.41
Green Cross Cloros Dry Bordo 22%	Lucas Kil-Tone Co.	Vineland, N. J.	Guaranteed Found	22.00 22.30
"Orchard Brand" Bordeaux	General Chemical Co.	San Francisco, Calif.	Guaranteed Found	12.50 12.82
Ortho Powdered Bordeaux	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	12.75 13.78

Copper carbonate and copper sulfate. Copper carbonate has been found very effective and less injurious than the older types of fungicides for bunt control in wheat. It should, therefore, be used instead of copper sulfate for smut control. As in the case of bordeaux mixture, the fineness of the dust particles is an important consideration. Most of the commercial brands have been improved to the extent that all particles pass through a 200-mesh sieve. This degree of fineness has been found satisfactory for effective adherence to the wheat seed.

Copper sulfate is available on the market in both the crystalline and powder forms.

Table X contains the analyses of samples of copper carbonate and copper sulfate inspected during the past season.

Copper and arsenic preparations and compounds. These preparations are usually proprietary mixtures of lead arsenate and dry bordeaux mix-

ture. Table XI reports the relative amounts of copper and arsenic oxide present in the mixtures.

Oil sprays. Commercial oil sprays are prepared from mineral oil or lubricating oil stock, which is the active insecticidal ingredient. In order that the oil droplets may be dispersed in the spray tank of water, an emulsion is made, using a third substance known as an emulsifying agent. Such substances include soap, calcium caseinate, gums, clays, and similar materials. It is necessary that a good-quality emulsion be produced in order that the oil may be dispersed uniformly in the water when diluted for spraying. If an emulsion breaks, the oil separates out, rising to the surface. Such broken emulsions should not be used since severe injury to the trees may ensue. Whenever appreciable quantities of free oil rise to the top of a

TABLE X. COPPER CARBONATE AND COPPER SULFATE

Brand	Name of manufacturer	Address	Guaranteed and found	Copper
Copper Carbonate				%
Carbo	Miller Products Co.	Portland, Oregon	Guaranteed Found	53.0 56.2
Copper Carbonate	Hood River Spray Co.	Hood River, Oregon	Guaranteed Found	..... 54.0
Copper Carbonate	Miller Products Co.	Portland, Oregon	Guaranteed Found	18.0 22.2
Mococo Copper Carbonate	Mountain Copper Co.	San Francisco, Calif.	Guaranteed Found	51.75 50.80
S-W Copper Carbonate	Sherwin-Williams Co.	Oakland, Calif.	Guaranteed Found	53.0 55.7
Copper Sulfate				
Copper Sulfate	Hood River Spray Co.	Hood River, Oregon	Guaranteed Found	25.5 26.5
Triangle Copper Sulfate	Nichols Copper Co.	New York, N.Y.	Guaranteed Found	25.0 26.8

TABLE XI. COPPER AND ARSENIC PREPARATIONS

	Name of manufacturer	Address	Guaranteed and found	Arsenic oxide		Copper
				%	%	
Acme Garden Guard	Acme White Lead & Color Works	Detroit, Mich.	Guaranteed Found	2.6 3.0	.5 .6	Also Sulfur 4.0% Also Sulfur 3.6%
Acme 2-Way Spray	Acme White Lead & Color Works	Detroit, Mich.	Guaranteed Found	4.3 4.5	11.0 10.8	
Dowco	Dow Chemical Co.	Midland, Mich.	Guaranteed Found	13.5 14.5	12.7 14.4	
Niagara D-20	Niagara Sprayer and Chemical Company	Middleport, N.Y.	Guaranteed Found	7.0 8.1	6.8 7.1	
Pestroy	Sherwin-Williams Company	Oakland, Calif.	Guaranteed Found	4.7 5.3	11.0 12.7	

barrel of oil spray, the spray should not be used but returned to the dealer or manufacturer.

The various commercial oil sprays may be classified as miscible oils, soap oil emulsions, and non–soap oil emulsions. The non–soap emulsions are also known as "cold mixed" emulsions. The miscible oils and the soap emulsions are more stable products and should be used for dormant spraying only. They should not be used in combination with arsenicals as a chemical reaction will occur, freeing water-soluble arsenic, that may cause severe foliage injury. The non–soap emulsions are recognized as the summer oil sprays and may be combined with the arsenicals for summer spraying.

The physical and chemical specifications of various oil sprays that are to be used for particular purposes are most important. For practical purposes a knowledge of the sulfonation test will indicate the degree of purification, and the viscosity in seconds Saybolt will indicate the type of oil—that is, whether light, medium, or heavy.

Oils that are to be used for dormant sprays may be comparatively low grade. A sulfonation test ranging anywhere between 50 and 70 will be found satisfactory. The viscosity also may have a wide range and may vary between 100 and 150 seconds Saybolt. Future experimental work, however, may show that for certain purposes an oil of more definite specifications may prove more effective.

Oil emulsions that are to be used for summer spraying should be carefully selected. Most important is the viscosity. For most purposes oils ranging in viscosity from 65 to 75 will prove satisfactory. When used on Newtown apples or other varieties susceptible to oil injury, however, the viscosity of the oil should not exceed 55. If oil sprays are to be used late in the season, complications in the removal of the spray residue will result if the viscosity of the oil is much above 55 seconds Saybolt. Oils will be of sufficient purity for summer spraying if the sulfonation test is about 85. If in doubt regarding the use of oil sprays, the orchardist should write to the Oregon Agricultural Experiment Station for more detailed information.

A few of the oil emulsions sold on the Oregon market are listed in Table XII, where the percentage of the main active ingredient, oil, is indicated.

Formaldehyde. Formaldehyde is another commonly used fungicide. All formaldehyde containers should be carefully labeled showing a minimum of 37.0 percent by weight. Consumers should demand this guarantee before accepting any shipments of formaldehyde. Table XIII shows the grade of products inspected during the past season.

Soap. Several brands of soap are offered on the market primarily as spray soaps. These are guaranteed to be either whale-oil or fish-oil products. There are the "hard" and "soft" whale-oil soaps. The soft soaps are the potash soaps, while the hard types are soda soaps. It is well to examine the label and purchase the soap on the guaranteed actual weight of the dry soap.

Pyrethrum sprays. Recently several pyrethrum sprays have come upon the Oregon market, some of which show promise as effective insecticides. Experimental work is now being carried on to learn what insects

may be controlled best with pyrethrum sprays. The public is warned to exercise care in the purchase of pyrethrum sprays, however, since some

TABLE XII. OIL SPRAY

Brand	Name of manufacturer	Address	Guaranteed and found	Mineral oil
				%
Avon Spray Emulsion	Associated Oil Company	San Francisco, Calif.	Guaranteed Found	84.0 85.5
Del Monte Spray Emulsion	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	83.0 86.7
Dormant Oil Emulsion	H. N. Leckenby	Seattle, Wash.	Guaranteed Found	80.0 81.5
Dormoil	Hood River Spray Company	Hood River, Oregon	Guaranteed Found	84.0 85.5
Extermol	Hood River Spray Company	Hood River, Oregon	Guaranteed Found	80.0 78.5
Medol A	Balfour, Guthrie & Co.	San Francisco, Calif.	Guaranteed Found	80.0 82.7
Medol I	Balfour, Guthrie & Co.	San Francisco, Calif.	Guaranteed Found	80.0 79.5
Neutral	Balfour, Guthrie & Co.	San Francisco, Calif.	Guaranteed Found	80.0 81.5
Nicona	Balfour, Guthrie & Co.	San Francisco, Calif.	Guaranteed Found	79.0 82.6
Orthol Kleenup A	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	80.0 83.5
Orthol K Medium	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	80.0 86.0
Orthol K Light	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	80.0 83.8
Petrotine 60	Associated Oil Company	San Francisco, Calif.	Guaranteed Found	83.0 85.2
Petrotine 70	Associated Oil Company	San Francisco, Calif.	Guaranteed Found	83.0 86.7
Redoilo	Miller Products Company	Portland, Oregon	Guaranteed Found	80.0 79.0
Summerol	Hood River Spray Company	Hood River, Oregon	Guaranteed Found	80.0 81.9
S. W. Summer Mulsion	Sherwin-Williams Co.	Oakland, Calif.	Guaranteed Found	83.0 84.8
Triple X Mulsion 60	Leffingwell Rancho Co.	Whittier, Calif.	Guaranteed Found	83.0 86.0
Volck Conc.	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	80.0 84.0
Volck Light	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	80.0 83.2
S.W. Free Mulsion	Sherwin-Williams Co.	Oakland, Calif.	Guaranteed Found	83.0 84.3

products may contain only a very small percentage of the active ingredient. The highly concentrated liquid extract of pyrethrum may be depended upon as effective when used in accordance with the recommendations of the Experiment Station. When in doubt regarding the value of the pyrethrum products, write to the Chemistry department of the Agricultural Experiment Station regarding them.

TABLE XIII. FORMALDEHYDE

Name of manufacturer	Address	Guaranteed and found	Formaldehyde (by wt.)
			%
D & B Chemical Company	Portland, Oregon	Guaranteed	37.0
		Found	21.8
The Roessler & Hasslacher Chemical Company	New York, N. Y.	Guaranteed	37.0
		Found	37.4

Mercuric fungicides. Recently several organic mercury compounds have been developed that have proved effective as fungicides and insecticides. Among these compounds may be listed semesan, ceresan, uspulun, and others. Some of these are reported in Table XIV.

Miscellaneous spray materials. The guaranteed and found amounts of the active ingredients of various miscellaneous materials are given in Table XIV. The purposes for which they are intended are self-evident from the active ingredients present. Most of the analyses are above the manufacturer's guarantee.

TABLE XIV. MISCELLANEOUS INSECTICIDES AND FUNGICIDES

Brand	Name of manufacturer	Address	Guaranteed and found	Active ingredients
				%
Aphesite	H. N. Leckenby	Seattle, Wash.	Guaranteed	Soap 40.0 Essential oil 2.0
			Found	Soap 45.6 Essential oil present
Bait-M	Acme White Lead and Color Works	Detroit, Mich.	Guaranteed	Arsenic 1.5
			Found	Arsenic 1.8
Ceresan	Bayer-Semesan Co.	New York, N.Y.	Guaranteed	Ethyl Mercury Chloride 1.6
			Found	Ethyl Mercury Chloride 2.7
Earwig Powder	H. N. Leckenby	Seattle, Wash.	Guaranteed	Sodium Fluoride 75.0
			Found	Sodium Fluoride 68.6
Getzum Fluid	Weed Destroyer Co.	Aberdeen, Wash.	Guaranteed	Arsenic 24.0
			Found	Arsenic 24.9
Kolokill	Niagara Sprayer & Chemical Co.	Middleport, N.Y.	Guaranteed	Arsenic oxide 4.5
			Found	Arsenic oxide 4.4

TABLE XIV. MISCELLANEOUS INSECTICIDES AND FUNGICIDES (*Continued*).

Brand	Name of manufacturer	Address	Guaranteed and found	Active ingredients
				%
London Purple	Acme White Lead and Color Works	Detroit, Mich.	Guaranteed Found	Arsenic 26.0 Arsenic 26.1
Magotite	H. N. Leckenby	Seattle, Wash.	Guaranteed Found	Sulfur 5.0 Napthlene 15.0 Sulfur 6.4 Napthlene present
Nu-Green	Bayer-Semesan Co.	New York, N.Y.	Guaranteed Found	Hydroxymercurichlorophenol sulfate 15.0 Hydroxymercurichlorophenol 22.9
Ortho Weed Killer	California Spray Chemical Co.	Watsonville, Calif.	Guaranteed Found	Arsenious oxide 22.0 Arsenious oxide 24.2
Semesan	Bayer-Semesan Co.	New York, N.Y.	Guaranteed Found	Hydroxymercurichlorophenol 30.0 Hydroxymercurichlorophenol 36.5
Semesan Bel.	Bayer-Semesan Co.	New York, N.Y.	Guaranteed Found	Hydroxymercurinitrophenol 2.0 Hydroxymercurichlorophenol 12.0 Hydroxymercurichlorophenol 13.5 Hydroxymercurinitrophenol 2.5
Semesan Jr.	Bayer-Semesan Co.	New York, N.Y.	Guaranteed Found	Hydroxymercuricresol 12.0 Hydroxymercuricresol 14.0
Sodium Fluoride	Montgomery Ward & Co.	Portland, Oregon	Guaranteed Found	Sodium Fluoride 65.0 Sodium Fluoride 89.6
Sodium Fluoride	General Chemical Co.	San Francisco, Calif.	Guaranteed Found	..... Sodium Fluoride 94.3
Weed Killer	Hood River Spray Co.	Hood River, Oregon	Guaranteed Found	..... Arsenious oxide 22.1
Atlacide	Chipman Chemical Engineering Co.	Bound Brook, N.J.	Guaranteed Found	Chlorate equivalent 45.5 Chlorate equivalent 46.8
Baito Earwig Bait	Miller Products Co.	Portland, Oregon	Guaranteed Found	Arsenic 2.10 Arsenic 4.04
Bait-M	Acme White Lead and Color Works	Detroit, Mich.	Guaranteed Found	Arsenic 1.60 Arsenic 1.73
Dryzen	Griffith-Lothrop Co.	Portland, Oregon	Guaranteed Found	Sodium Fluoride 4.9 Sodium Fluoride 4.8
End-O-Pest	Agricultural Chemical Works	Los Angeles, Calif.	Guaranteed Found	Arsenic 1.53 Arsenic 1.88
Portland Earwig Bait	Miller Products Co.	Portland, Oregon	Guaranteed Found	Arsenic 3.10 Arsenic 2.98
Snarol	Antrol Laboratories	Los Angeles, Calif.	Guaranteed Found	Arsenic 1.74 Arsenic 2.51
Wigotox Earwig Bait	Durbocide Chemical & Machine Corp.	Portland, Oregon	Guaranteed Found	Sodium arsenite 3.5 Sodium arsenite 3.1